3.1 Intro to Quadratic Relations

So far: Linear Relations	New: Quadratic Relations
Equation: $y = mx + b$	Equation: $y = ax^2 + bx + c$
m is slope, b is y-intercept	a, b, and c are coefficients
highest exponent of x is 1	highest exponent of x is 2 (degree, or order, of 2)

Standard form

Recall: To graph a relationship, we can use a table of values (or TOV).

1. Pick some values for x (some positive & negative)
2. Sub each x-value into the equation.
3. Determine values for y.
4. Plot each point (x, y) on the x-y plane.
5. (Optional) Calculate first differences, which are the differences between *consecutive* y-values for *consecutive* x-values.

Create a TOV for y = 2x + 1

first differences

x	y = 2x + 1	$\Delta y = y_2 - y_1$
-2	2(-2)+1 = -3	
		-1-(-3) = 2
-1	2(-1)+1 = -1	
		1-(-1) = 2
0	2(0)+1 = +1	
		3-(1) = 2
1	2(1)+1 = 3	
		5-(3) = 2
2	2(2)+1 = 5	

TOV

(x, y)

(-2, -3)

(-1, -1)

(0, 1)

(1, 3)

(2, 5)

'Δ' (delta) means "change in" or "difference".
Δy is the change in y, or the first difference.

In a linear relationship, the first differences are Constant!

Ex.1. Create a TOV for $y = x^2$

Parent

$-2^2 = -4$

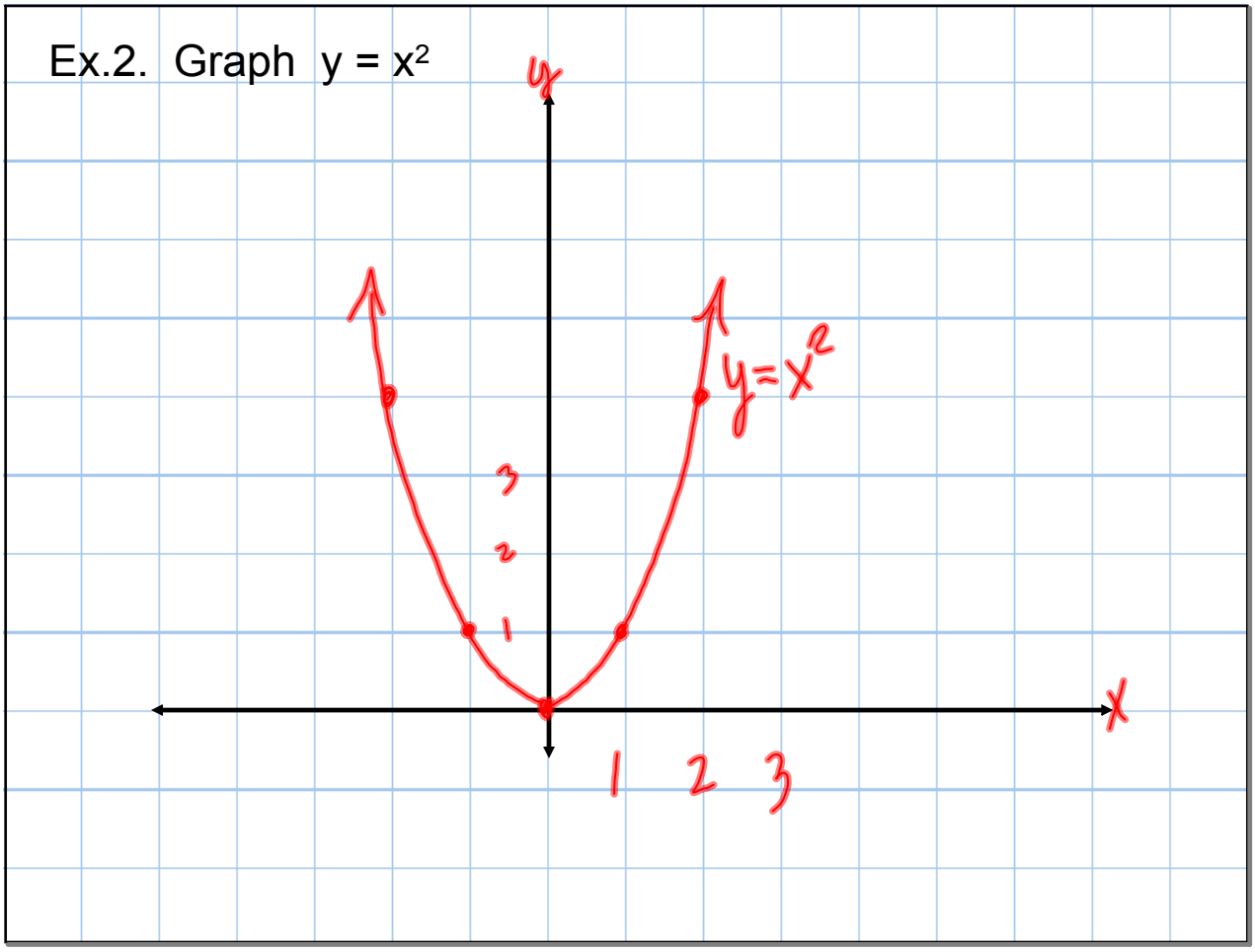
$(-2)^2 = 4$

x	$y = x^2$	Δy 1st	$\Delta^2 y$ 2nd
-2	$(-2)^2 = 4$		
		1-(4) = -3	
-1	$(-1)^2 = 1$		-1-(-3) = 2
		0-(1) = -1	
0	$(0)^2 = 0$		1-(-1) = 2
		1-0 = 1	
1	$(1)^2 = 1$		3-(1) = 2
		4-(1) = 3	
2	$(2)^2 = 4$		

$\Delta^2 y$ is the change in Δy, or change in 1st differences.
$\Delta^2 y$ is the second difference.

In a quadratic relationship, first differences are different
and second differences are Constant.

Ex.2. Graph $y = x^2$



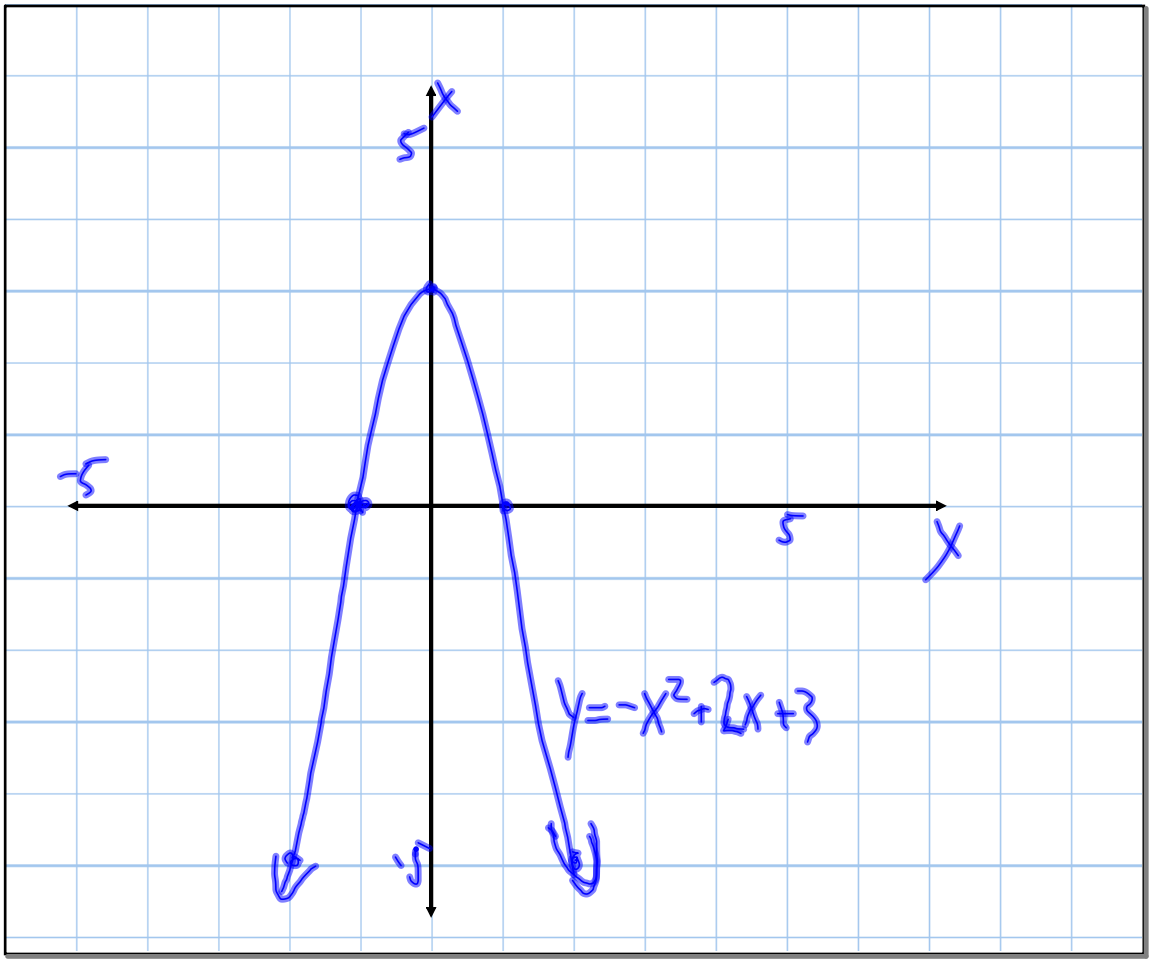
Ex.3. Create a TOV and graph $y = -x^2 + 2x + 3$.

x	$y = -x^2 + 2x + 3$	Δy 1st	$\Delta^2 y$ 2nd
-2	$-(-2)^2+2(-2)+3 = -5$		
		$0-(-5) = 5$ R	
-1	$-(-1)^2+2(-1)+3 = 0$		$3-(5) = -2$
		$3-(0) = 3$ R	
0	$-(0)^2+2(0)+3 = 3$		$1-(3) = -2$ R
		$4-(3) = 1$ R	
1	$-(1)^2+2(1)+3 = 4$		$-1-(1) = -2$
		$3-(4) = -1$ R	
2	$-(2)^2+2(2)+3 = 3$		

Graph

2nd differences negative

opens down



For any parabola, $y = ax^2 + bx + c$, the direction of opening can be determined from:

- the graph
- the sign of the 2nd difference
- the sign of "a"

Positive "a" value
Positive 2nd difference $\Rightarrow$ parabola opens Up.

Negative "a" value
Negative 2nd difference $\Rightarrow$ parabola opens Down.

Assigned Work:
p. 137 # 1, 2, 3, 4, 5ab, 6, 7